

CLAIMS

- 1 1. An object which, in its outer surface contains a color-forming composition which
2 comprises:
 - 3 a. a solvent-absorbing material;
 - 4 b. a color former compounded with said solvent-absorbing material, wherein said
5 color former functions as a metal chelating agent; and
 - 6 c. metal ions capable of forming a chelate complex with said color former as said
7 solvent-absorbing material absorbs said solvent, resulting in a detectable color
8 change of said composition.
- 1 2. The object of claim 1 wherein said solvent absorbing material is a polymer
- 1 3. The object of claim 2 wherein the solvent absorbing material is selected from the
2 group consisting of polyethylene acrylic acid, polyethylene methacrylic acid, and
3 copolymers thereof; terpolymers of polyethylene, an acrylic acid and an acrylate;
4 polyurethane; poly-(acrylonitrile-butadiene-styrene); polyvinylchloride;
5 polypropylene copolymer; polystyrene; polyurethane; silicon elastomers; organic
6 rubbers; and combinations thereof.
- 1 4. The object of claim 3 wherein said solvent absorbing material is polyethylene
2 methacrylic acid, polyethylene acrylic acid, and mixtures thereof.
- 1 5. The object of claim 4 wherein said color-forming composition exhibits
2 thermoxidative stability at compounding temperatures of at least about 90⁰C.

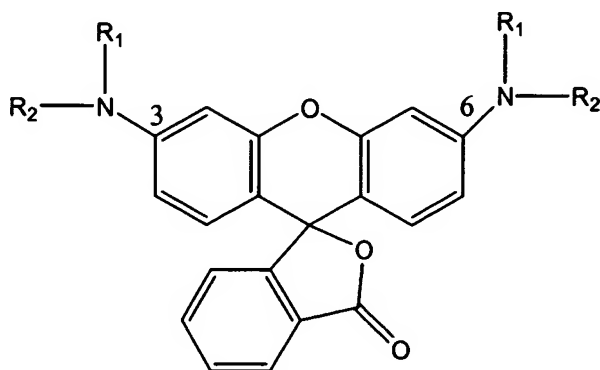
- 1 6. The object of claim 5 wherein said color-forming composition exhibits
2 thermoxidative stability at extrusion temperatures of at least about 180⁰C.
- 1 7. The object of claim 2 wherein said solvent absorbing material is a paint.
- 1 8. The object of claim 3 wherein said metal ions are selected from the group
2 consisting of Na⁺, Li⁺, Zn²⁺, Fe³⁺, Fe²⁺, Ca²⁺, Mg²⁺, Li⁺, Ti²⁺, Ti⁴⁺, Mn²⁺, and
3 combinations thereof.
- 1 9. The object of claim 8 wherein said metal ion is Zn²⁺.
- 1 10. The object of claim 8 wherein said metal ions are contained in said solvent
2 absorbing material.
- 1 11. The object of claim 9 wherein the metal ions are provided by zinc acetate.
- 1 12. The object of claim 11 wherein the zinc acetate is present from about 0.1% to
2 about 2.5%, by weight of the composition.
- 1 13. The object of claim 8 wherein said color former produces a permanent color
2 change which is not reversed by removal of said solvent from said solvent
3 absorbing material.
- 1 14. The object of claim 13 wherein said color former is a 1,2-dihydroxybenzene
2 derivative.

1 15. The object of claim 14 wherein said color former is selected from the group
2 consisting of 1,2-dihydroxybenzene, 3-methylcatechol, 4-methylcatechol, 4,5-
3 dihydroxy-1,3-benzenedisulfonic acid disodium salt and 1,2,3-trihydroxybenzene
4 and mixtures thereof.

1 16. The object of claim 15 wherein said color former is 1,2-dihydroxybenzene and is
2 present in the composition at from about 0.1% to about 2.5%, by weight.

1 17. The object of claim 8 wherein the color change is reversible when the absorbed
2 solvent is removed from said outer covering.

1 18. The object of claim 17 wherein said color former is a substituted fluoran
2 derivative with at least one amine group at positions 3 and 6.



1 19. The object of claim 18 wherein R1 and R2 of the amine group are alkyl groups
2 containing from one to six carbon atoms independently.

1 20. The object of claim 19 wherein said color former is selected from the group
2 consisting of 3-diethylamino-6-methyl-fluoran, 3-dimethylamino-6-methyl-
3 fluoran, 3-dimethylamino-6-methyl-7-anilino-fluoran, 2-anilino-3-methyl-6-

4 dibutylaminofluoran, 3-diethylamino-6-methyl-7-anilinofluoran, and 2-anilino-3-
5 methyl-6-diethylaminofluoran and mixtures thereof.

1 21. The object of claim 18 wherein a fixative is added to retard reversal of said color
2 change and wherein said fixative is present at from about 0.1% to about 2.5%, by
3 weight.

1 22. The object of claim 21 wherein the fixative is a phenolic-based compound.

1 23. The object of claim 22 wherein the fixative is salicylic acid or bisphenol-A, the
2 acetate derivatives thereof and mixtures thereof.

1 24. The object of claim 1 wherein the object is a golf ball.

1 25. The object of claim 25 wherein said solvent-absorbing material is polyethylene
2 methacrylic acid; said color-former is from about 0.1% to about 2.5%, by weight
3 of a 1,2-dihydroxybenzene derivative; and said metal ion is Zn^{2+} , in an amount of
4 from about 0.1% to about 2.5%, by weight.

1 26. A solvent-activated, color-forming composition, comprising:

- 2 a. a solvent-absorbing material;
- 3 b. a color former compounded with said solvent-absorbing material, wherein
4 said color former functions as a metal chelating agent; and
- 5 c. metal ions capable of forming a chelate complex with said color former as
6 said solvent-absorbing material absorbs a solvent, resulting in a detectable
7 color change of said composition.

1 27. The composition of claim 26 wherein said solvent absorbing material is a polymer
2 selected from the group consisting of polyethylene acrylic acid, polyethylene
3 methacrylic acid, and copolymers thereof; terpolymers of polyethylene, an acrylic
4 acid and an acrylate; polyurethane; poly-(acrylonitrile-butadiene-styrene);
5 polyvinylchloride; polypropylene copolymer; polystyrene; silicon elastomers;
6 organic rubbers; and combinations thereof.

1 28. The composition of claim 27 wherein said solvent absorbing material is
2 polyethylene methacrylic acid or polyethylene acrylic acid and mixtures thereof.

1 29. The composition of claim 27 wherein said metal ions are selected from the group
2 consisting of Na^+ , Li^+ , Zn^{2+} , Fe^{2+} , Fe^{3+} , Ca^{2+} , Mg^{2+} , Li^+ , Ti^{2+} , Ti^{4+} , Mn^{2+} , and
3 combinations thereof and wherein said metal ions are present at from about 0.1%
4 to about 2.5%, by weight.

1 30. The composition of claim 29 wherein said metal ions are contained in said
2 solvent absorbing material.

1 31. The composition of claim 29 wherein said metal ions are provided by zinc acetate.

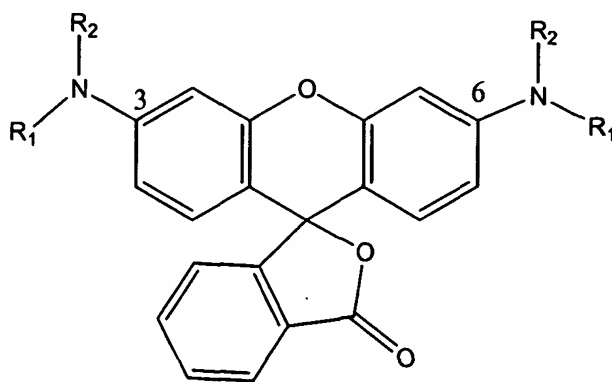
1 32. The composition of claim 29 wherein said color former produces a permanent
2 color change which is not reversed by removal of said solvent from said solvent
3 absorbing material.

1 33. The composition of claim 32 wherein said color former is a 1,2-dihydroxybenzene
2 derivative and wherein said color former is present at from about 0.1% to about
3 2.5%, by weight.

1 34. The composition of claim 33 wherein said color former is selected from the group
2 consisting of 1,2-dihydroxybenzene, 3-methylcatechol, 4-methylcatechol, 4,5-
3 dihydroxy-1,3-benzenedisulfonic acid disodium salt and 1,2,3-trihydroxybenzene
4 and mixtures thereof.

1 35. The composition of claim 29 wherein said color change is reversible when the
2 absorbed solvent is removed from said composition.

1 36. The composition of claim 35 wherein said color former is a substituted fluoran
2 derivative with at least one amine group at positions 3 and 6,



3
4
5 wherein R₁ and R₂ of the amine group are alkyl groups containing from one to six
6 carbon atoms independently and wherein said color former is present at from about
7 0.1% to about 2.5%, by weight.

1 37. The composition of claim 36 wherein said color former is selected from the group
2 consisting of 3-diethylamino-6-methyl-fluoran, 3-dimethylamino-6-methyl-
3 fluoran, 3-dimethylamino-6-methyl-7-anilino-fluoran, 2-anilino-3-methyl-6-
4 *dibutyl*amino-fluoran, 3-diethylamino-6-methyl-7-anilino-fluoran, and 2-anilino-3-
5 methyl-6-diethylamino-fluoran and mixtures thereof.

1 38. The composition of claim 36 wherein a fixative is added to retard reversal of said
2 color change and wherein said fixative is present at from about 0.1% to about
3 2.5%, by weight.

1 39. The composition of claim 38 wherein said fixative is a phenolic-based compound.

1 40. The composition of claim 39 wherein said fixative is selected from salicylic acid,
2 bisphenol-A, acetate derivatives of salicylic acid and bisphenol A, and mixtures
3 thereof.

1 41. A method for indicating exposure of a color-forming composition to a solvent,
2 said method comprising:
3 (a) providing a solvent;
4 (b) providing a solvent-absorbing material;
5 (c) compounding a color-former which functions as a metal chelating agent,
6 with said solvent-absorbing material;
7 (d) providing metal ions; and
8 (e) contacting said solvent-absorbing material with said solvent,
9 whereby as said solvent is absorbed by said solvent-absorbing material, said metal

10 ions contact and chelate with said color former resulting in a detectable color change
11 of said composition.

1 42. The method of claims 41 wherein

2 said solvent is water;

3 said solvent absorbing material is a polymer selected from the group consisting
4 of polyethylene acrylic acid, polyethylene methacrylic acid, and copolymers
5 thereof;

6 said color former is a 1,2-dihydroxybenzene derivative selected from the group
7 consisting of 1,2-dihydroxybenzene, 3-methylcatechol, 4-methylcatechol, 4,5-
8 dihydroxy-1,3-benzenedisulfonic acid disodium salt and 1,2,3-
9 trihydroxybenzene and mixtures thereof; and said metal ion is Zn^{2+} .

1 43. The method of claims 42 wherein

2 said solvent is water;

3 said solvent absorbing material is a polymer selected from the group consisting
4 of polyethylene acrylic acid, polyethylene methacrylic acid, and copolymers
5 thereof;

6 said color former is a substituted fluoran derivative with at least one amine
7 group at positions 3 and 6, wherein R1 and R2 of the amine group are alkyl
8 groups containing from one to six carbon atoms independently;
9 and said metal ion is Zn^{2+} .

1 44. The method of claim 43 wherein a fixative is added to said composition, said

2 fixative comprising acetylsalicylic acid or bisphenol diacetate and mixtures
3 thereof.